A Perspective on Future Energy Trends for the United States

For The Michigan Agri-Energy Conference

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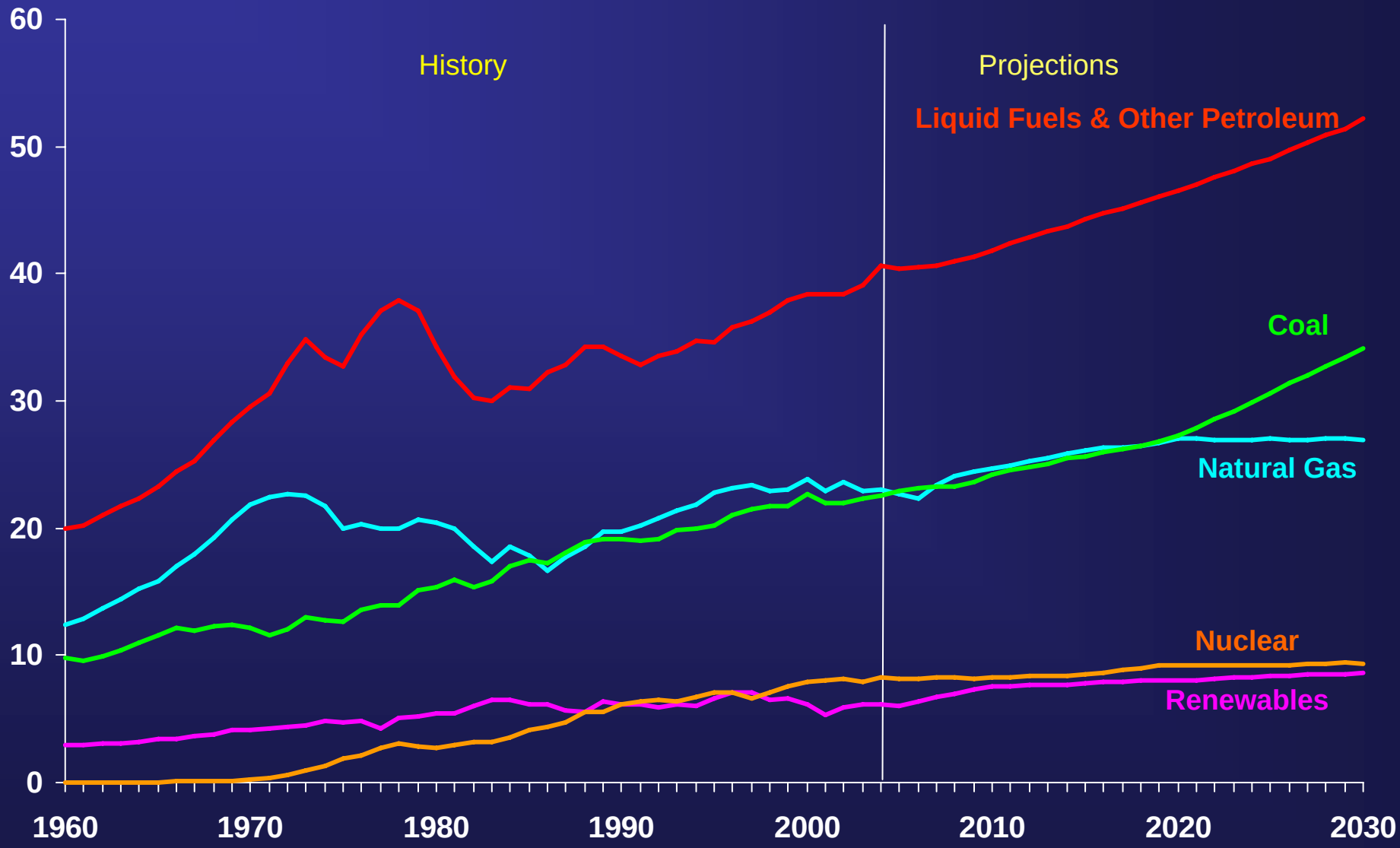
Energy issues to consider....

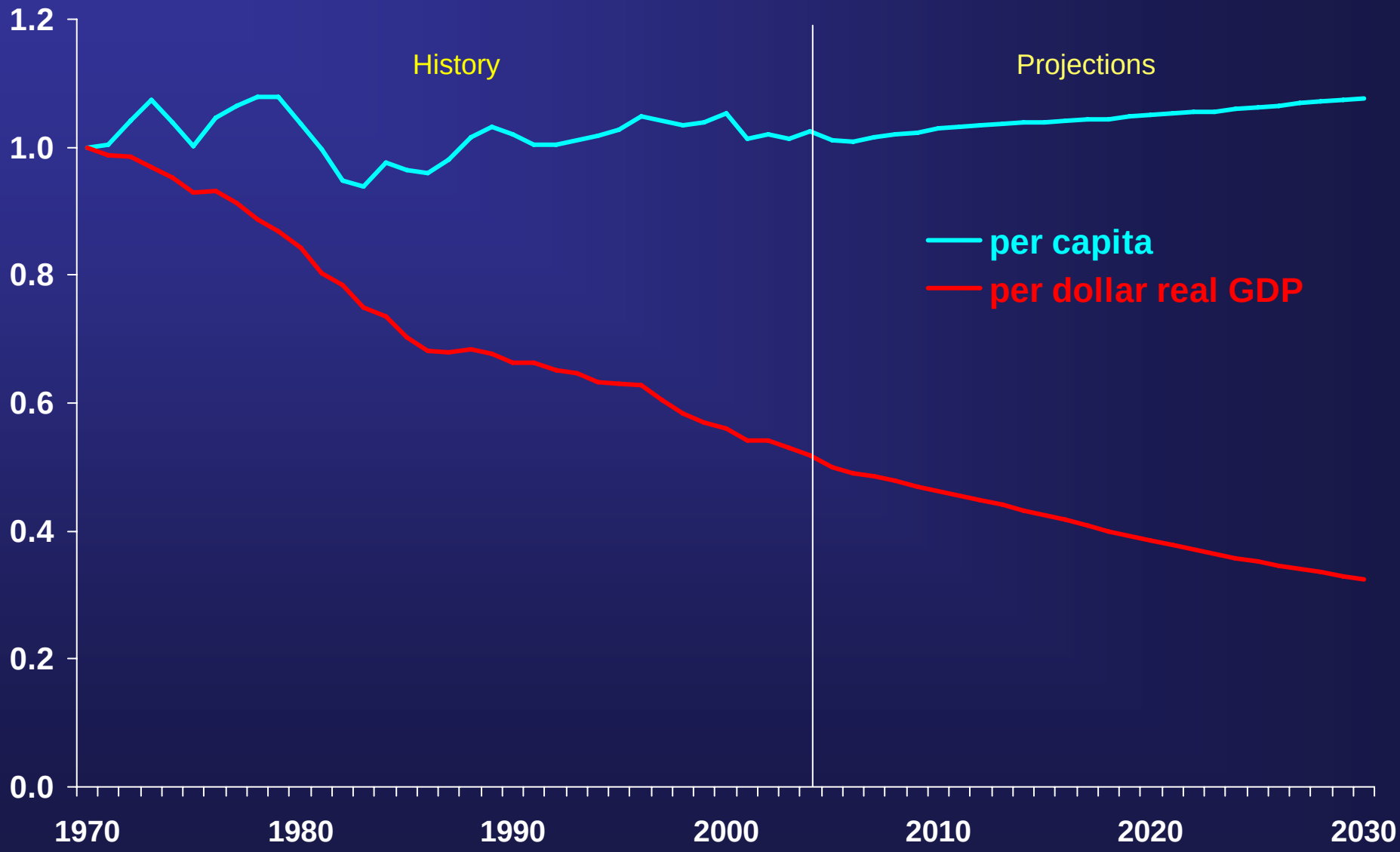
- How are energy trends changing?
- What role will ethanol play in the future?
- How big a contribution can alternative sources of distillate fuel oil, such as coal-to-liquids and biodiesel, make to energy supply?
- What is the role for unconventional vehicle technologies?
- How large of a contribution will LNG make to meeting energy requirements?
- Will coal continue to play a dominant role in U.S. electricity generation?
- What role will nuclear generation play in meeting electricity requirements?

World Oil Price, 1980-2030
(2005 dollars per barrel)

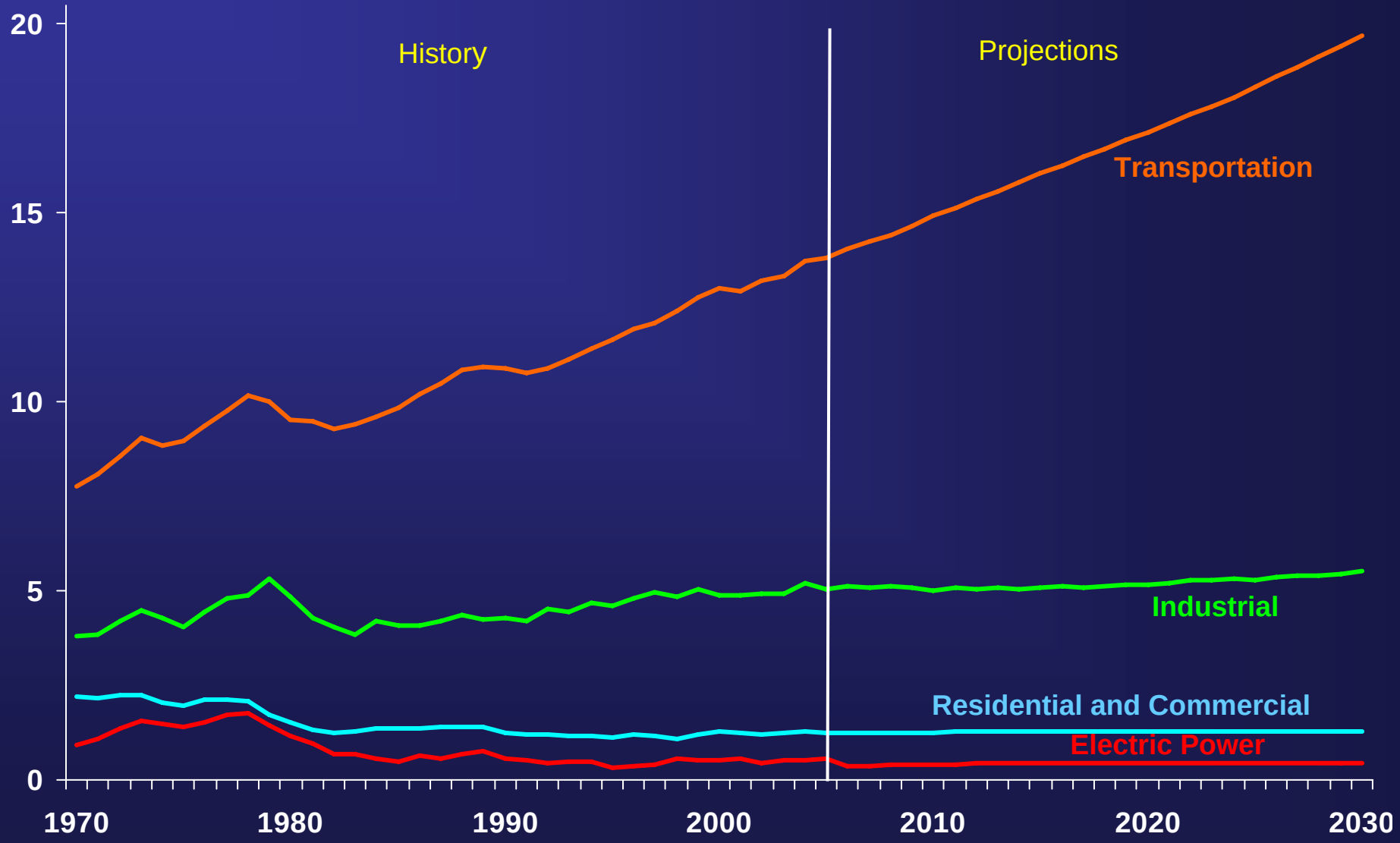
U.S. Primary Energy Consumption by Fuel, 1960-2030 (quadrillion Btu)



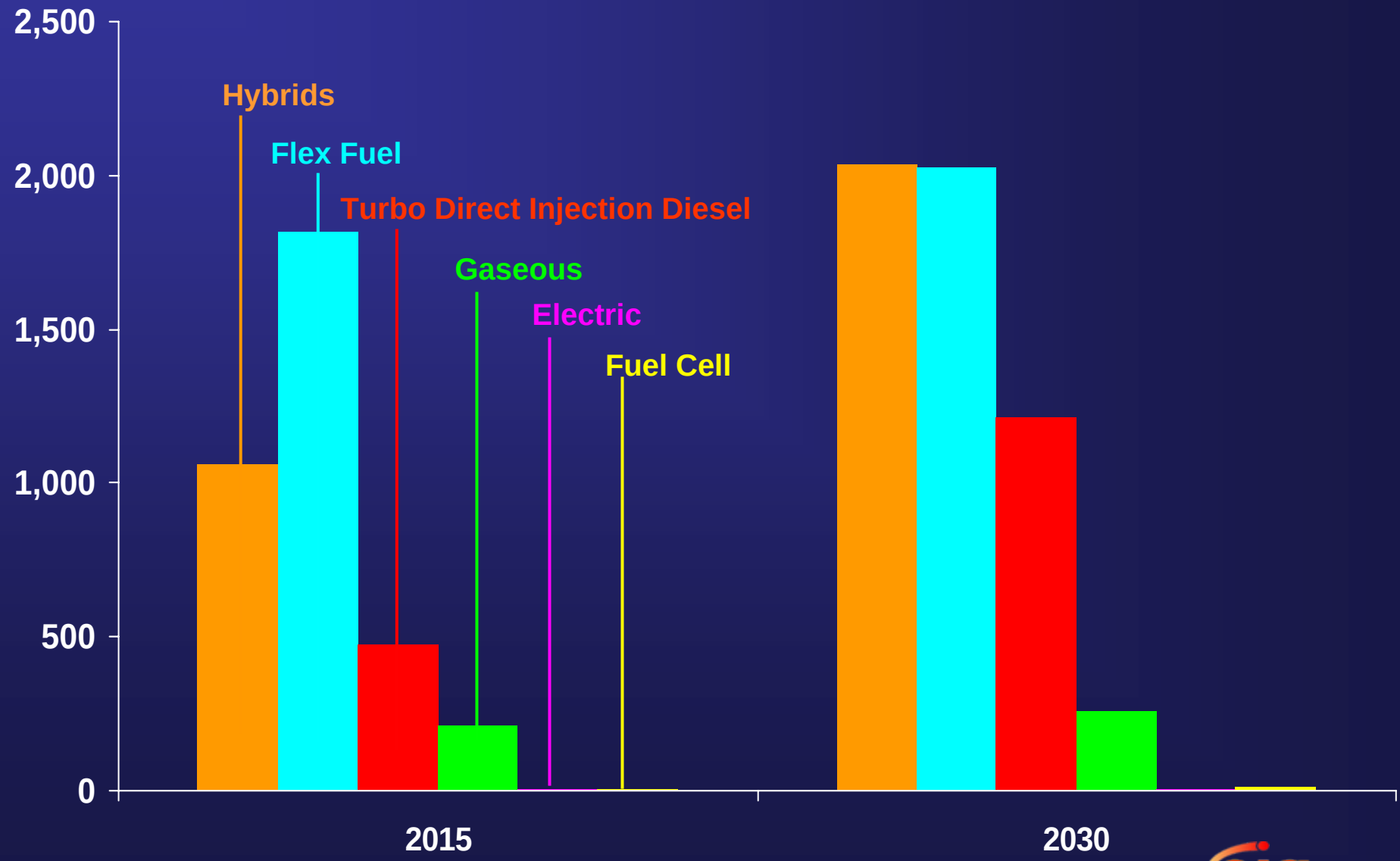
U.S. Energy Use per Capita and per Dollar of Real Gross Domestic Product, 1970-2030 (index, 1970 = 1)



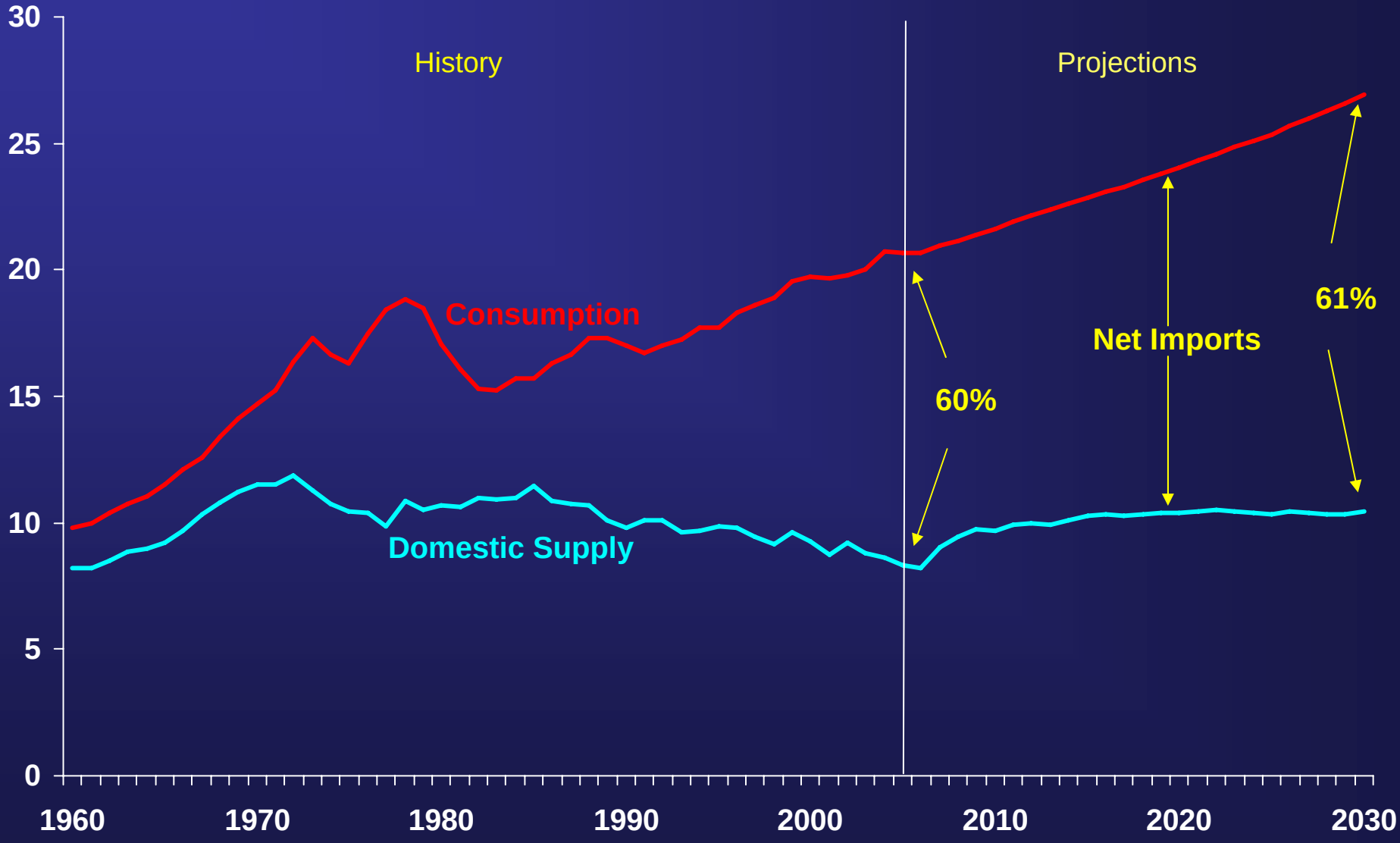
Consumption of Liquids and Other Petroleum Products by Sector, 1970-2030 (million barrels per day)



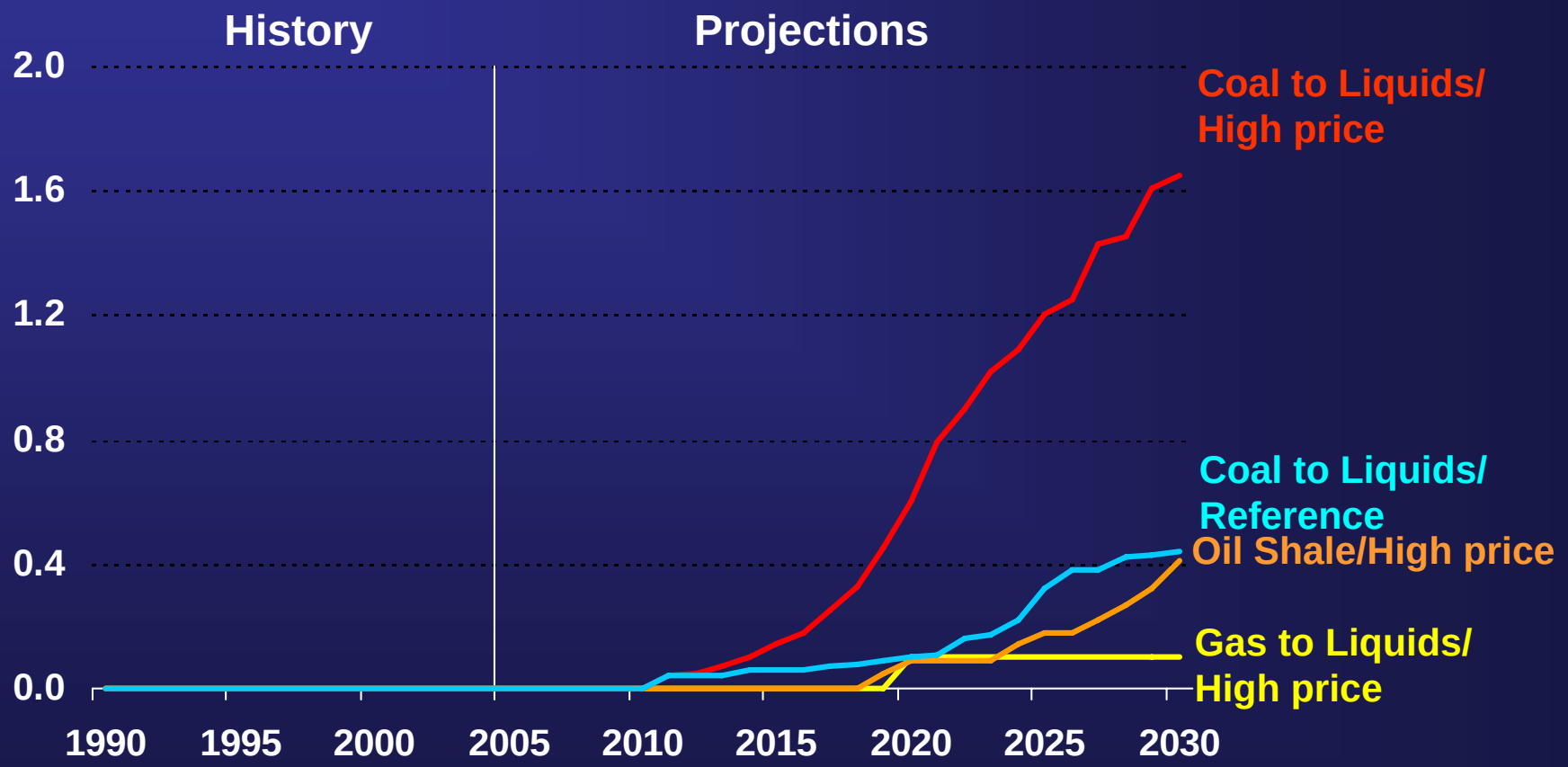
U.S. Sales of Unconventional Light-Duty Vehicles, 2015 and 2030 (thousand vehicles sold)



U.S. Petroleum/Liquids Supply, Consumption, and Net Imports, 1960-2030 (million barrels per day)



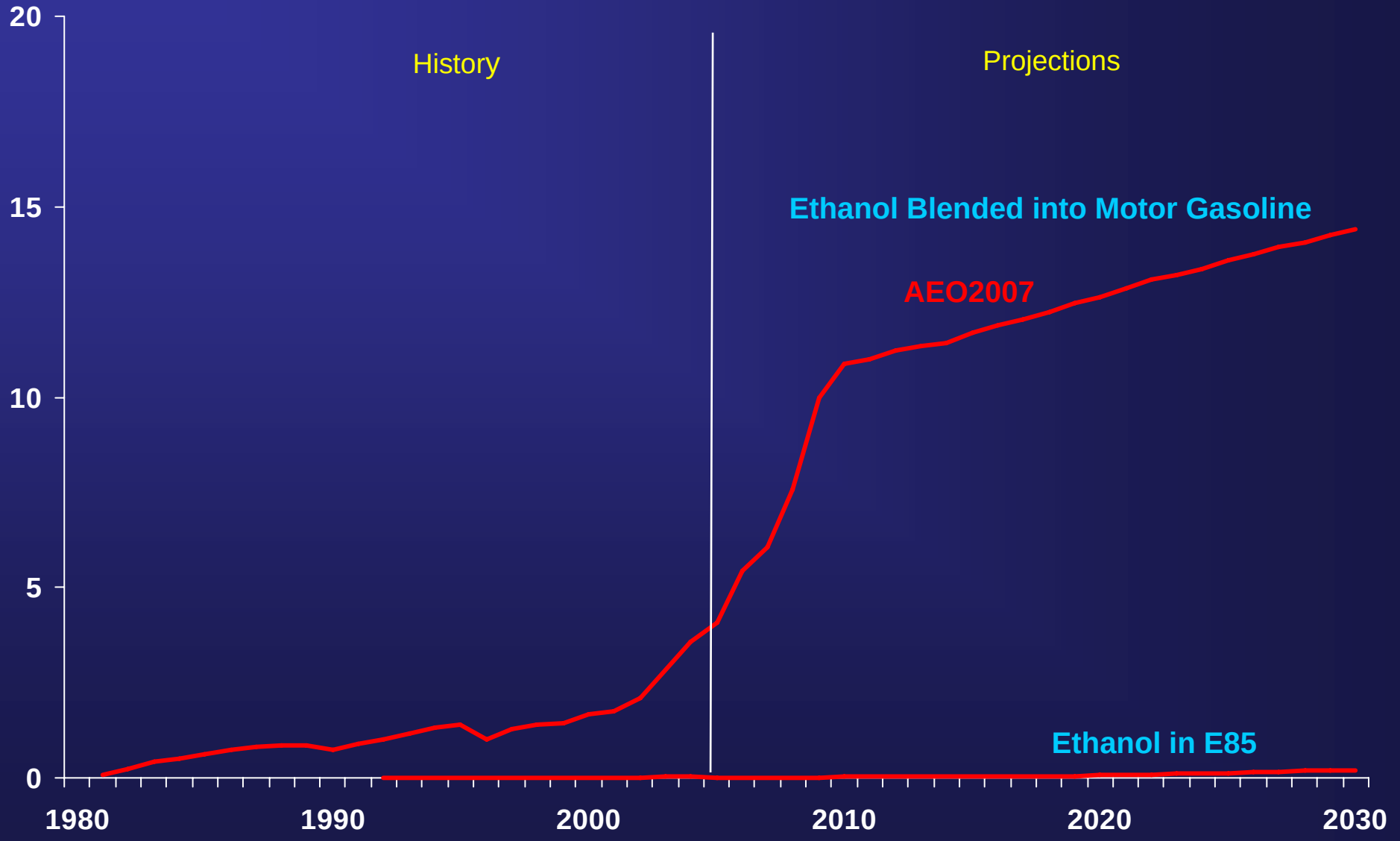
Gas-to-Liquids, Coal-to-Liquids, and Oil Shale Production in the Price Cases, 1990-2030 (million barrels per day)



Distinct Markets for Biofuels

- Octane/clean components
  - Lowest price sensitivity: "must have" item.
    - Example: Demand for ethanol in the aftermath of the phaseout of MTBE in spring 2006
- Volume enhancement
  - Price competition with conventional fuels on a volume (per gallon) basis
  - Key drivers include oil prices, biofuels tax benefits, and biofuels feedstock prices
- Energy Market
  - Price competition with conventional fuels on an energy content (per Btu) basis
  - Sensitive to availability of fuel and vehicle infrastructure

Ethanol Consumption as E85 and Blended with Motor Gasoline, 1981-2030 (billion gallons)

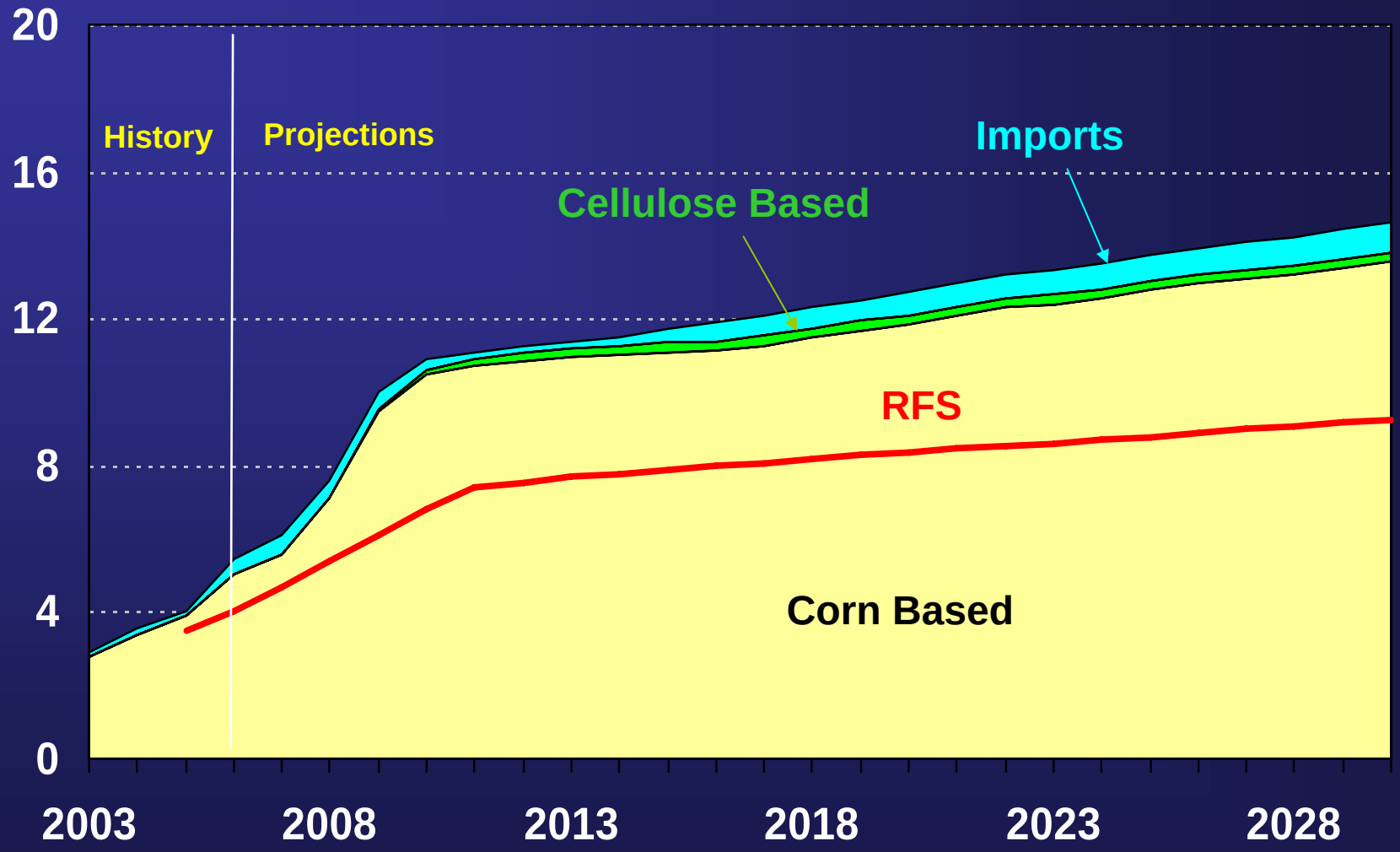


Annual Energy Outlook 2006 and 2007

Key Questions for Biofuels

- Cost
  - Feedstock costs
  - Capital costs
- Scalability
  - The biomass supply curve is upward sloping, although its location can shift over time
  - The liquid fuels sector is very “large” relative to the biomass sector
    - Displacement of even a modest share of petroleum use requires massive amounts of biomass
- Credits

Ethanol Supply by Source, 2003-2030 (billion gallons)



Impact of Alternative Fuels Mandates: Details Matter

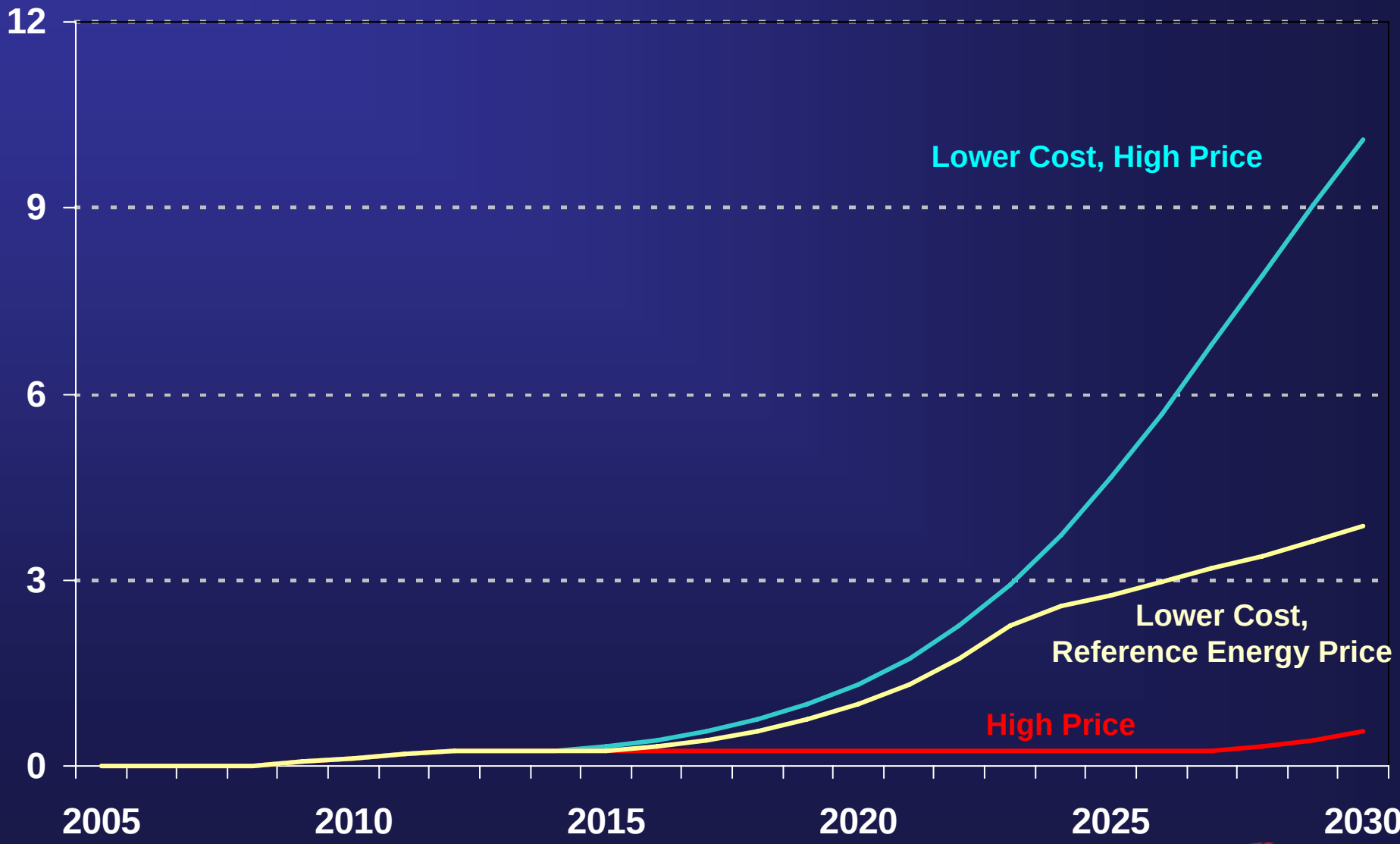
Alternative Fuel Mandate Provisions

- Safety valve provisions
- What fuels are included, and at what ratios
- Potential role of imports supplies

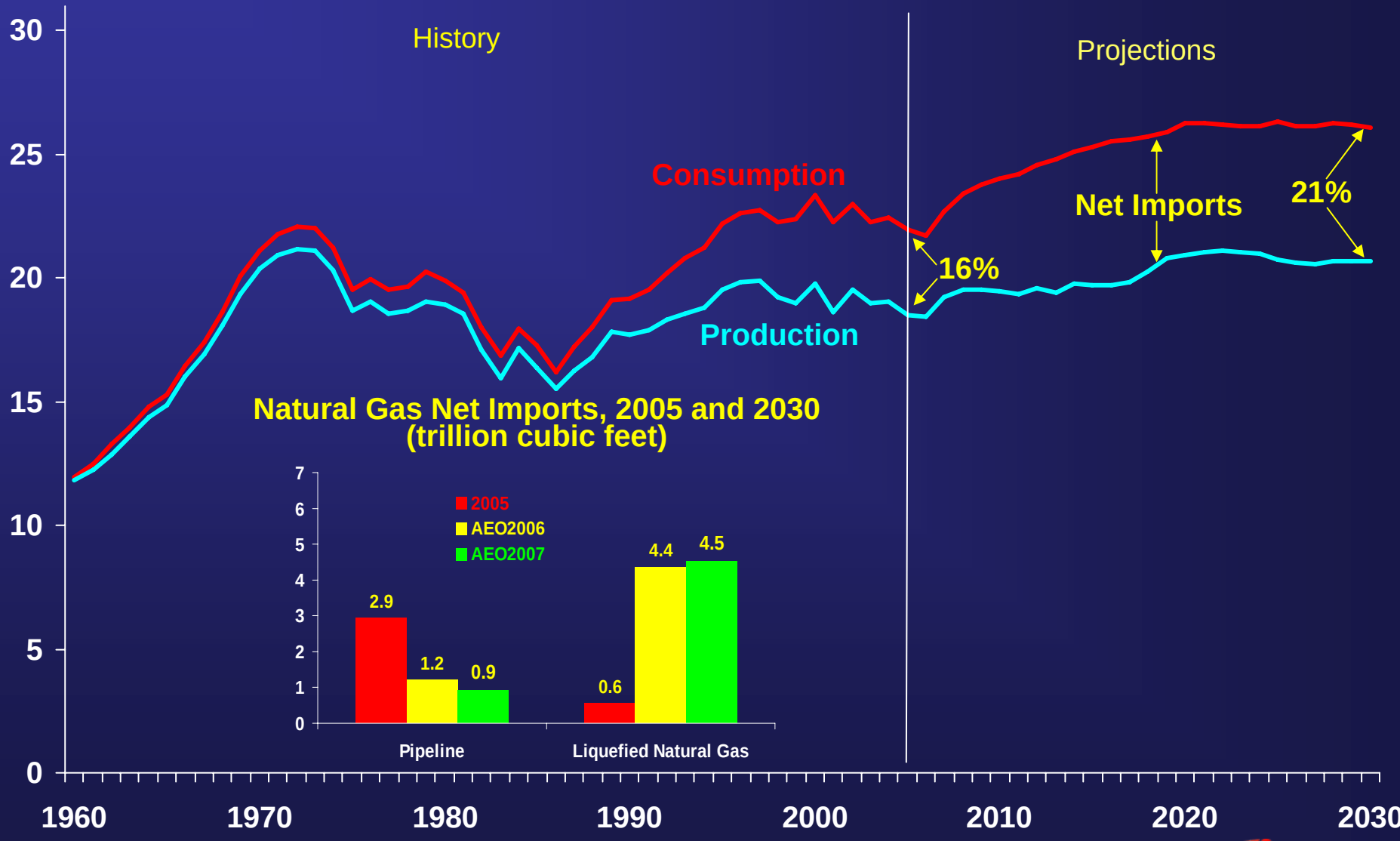
Other policies and market factors

- Oil prices
- Vehicle and fuel infrastructure considerations
- Trends in yield improvements
- Agricultural and land use policies
- Rate of cost reduction in advanced biofuels technologies

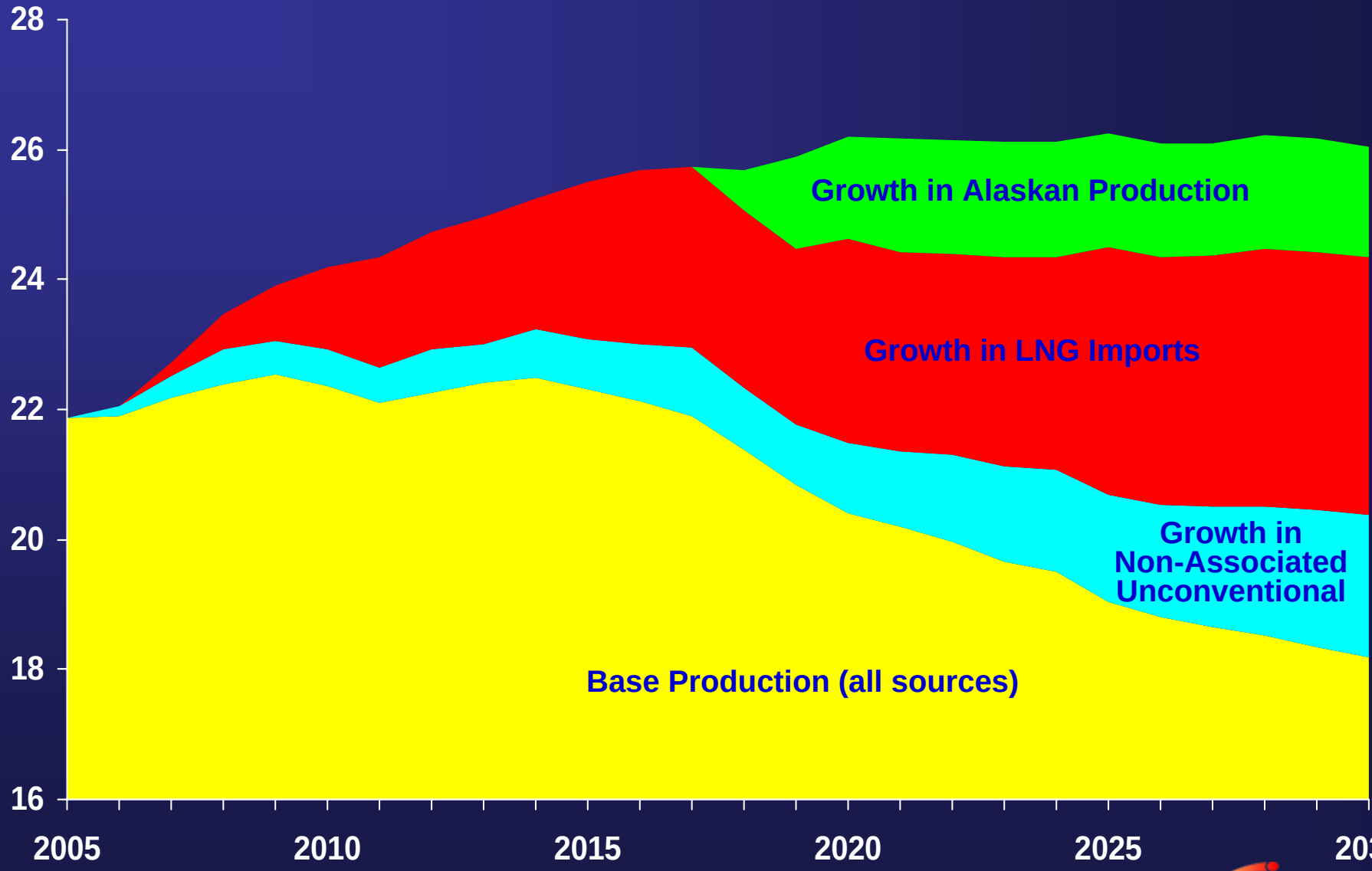
Cellulose Ethanol Production Under Lower Cost Scenarios, 2005-2030 (billion gallons per year)



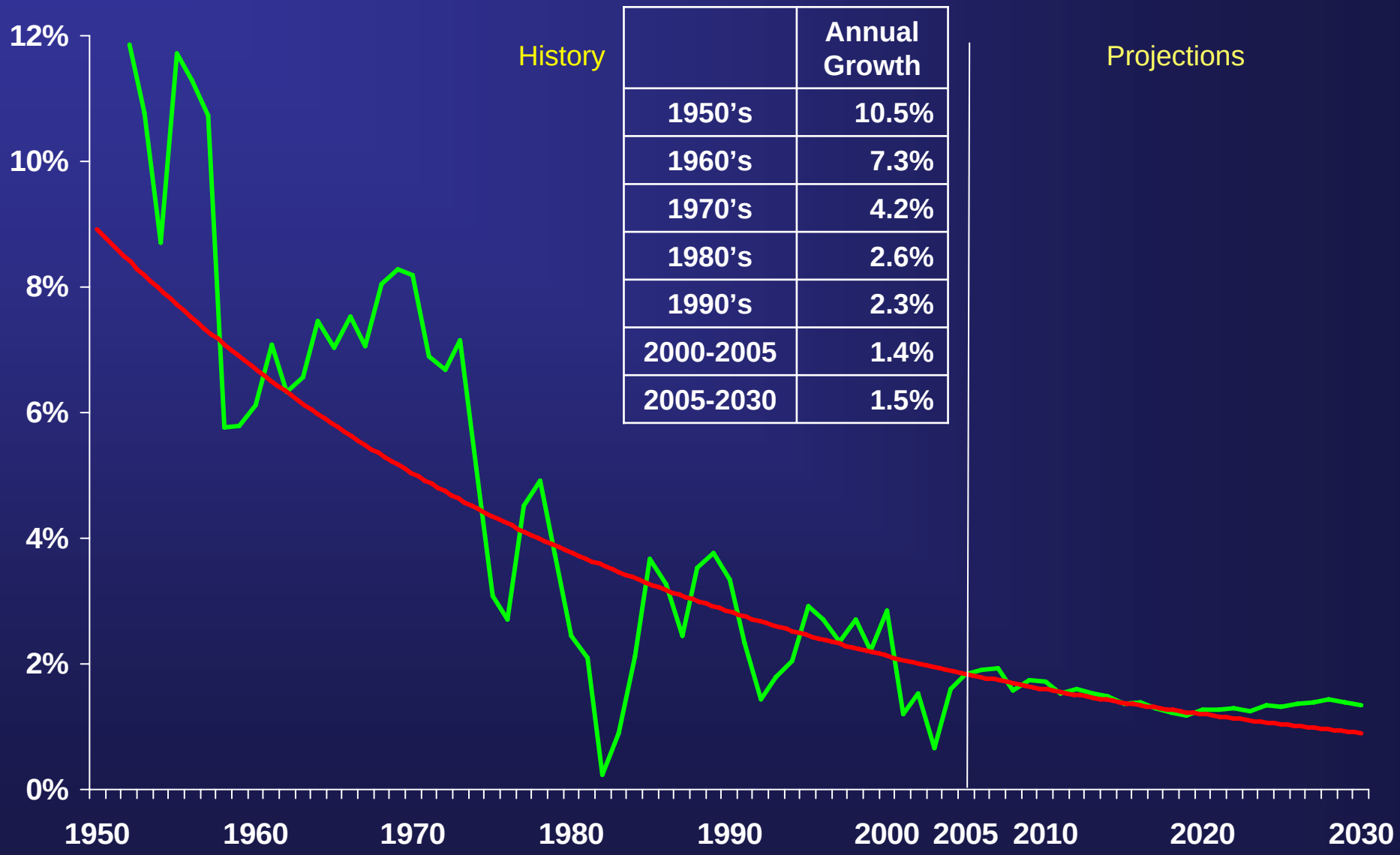
U.S. Natural Gas Production, Consumption, and Net Imports, 1960-2030 (trillion cubic feet)



Major Sources of Incremental U.S. Natural Gas Supply, 2006-2030 (trillion cubic feet)

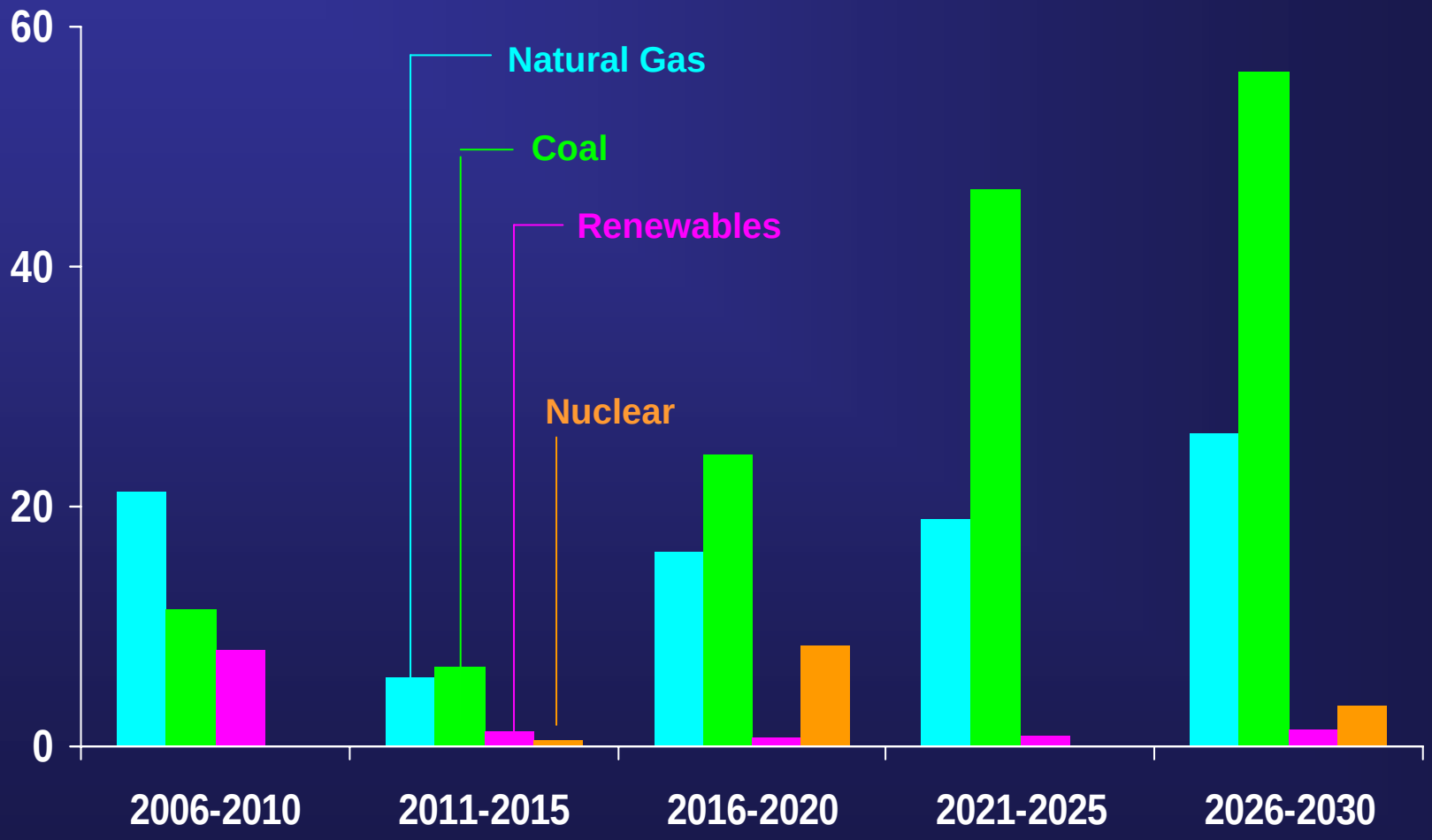


3-Year Rolling Average Electricity Demand Growth (with exponential trend line)

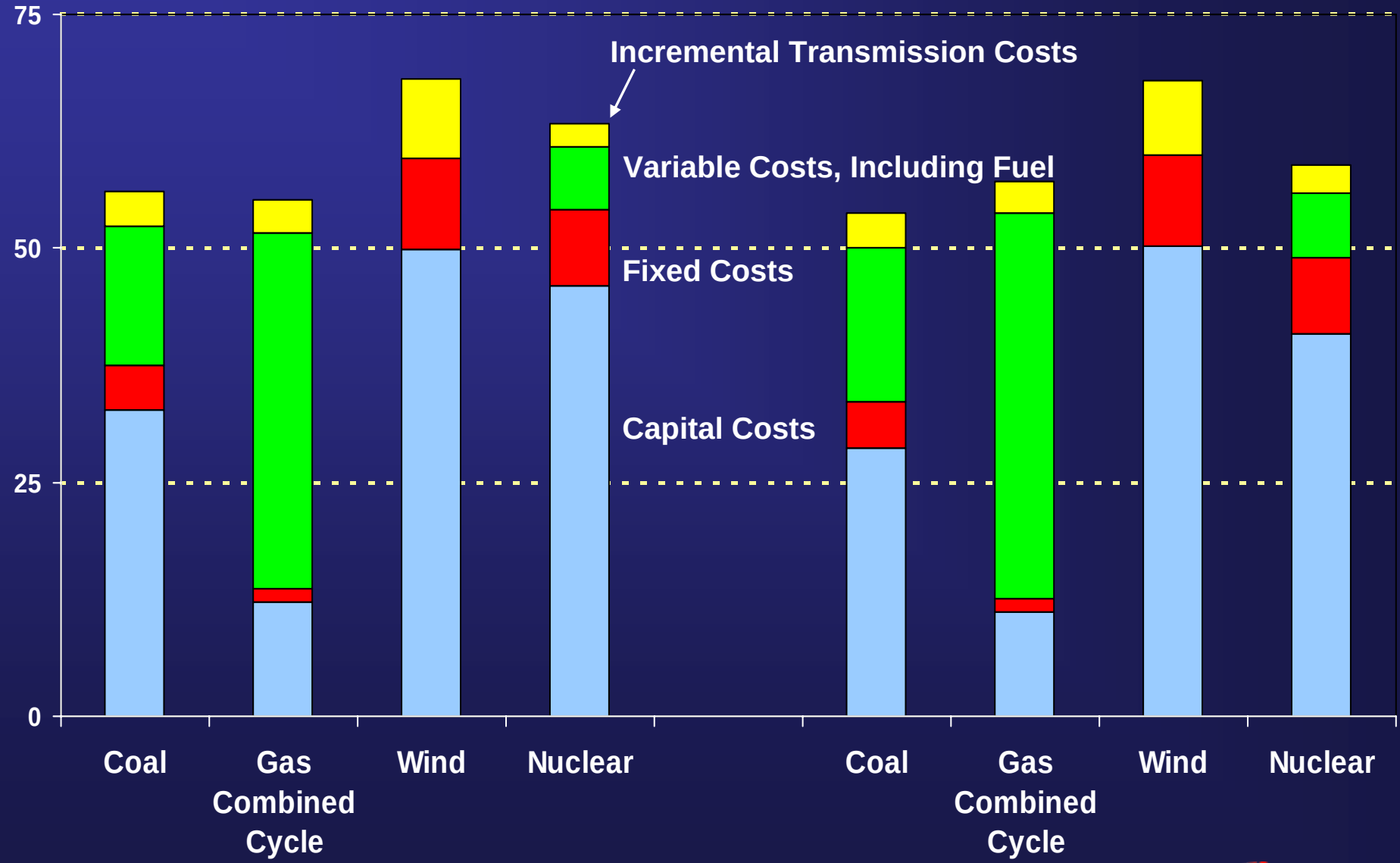


	Annual Growth
1950's	10.5%
1960's	7.3%
1970's	4.2%
1980's	2.6%
1990's	2.3%
2000-2005	1.4%
2005-2030	1.5%

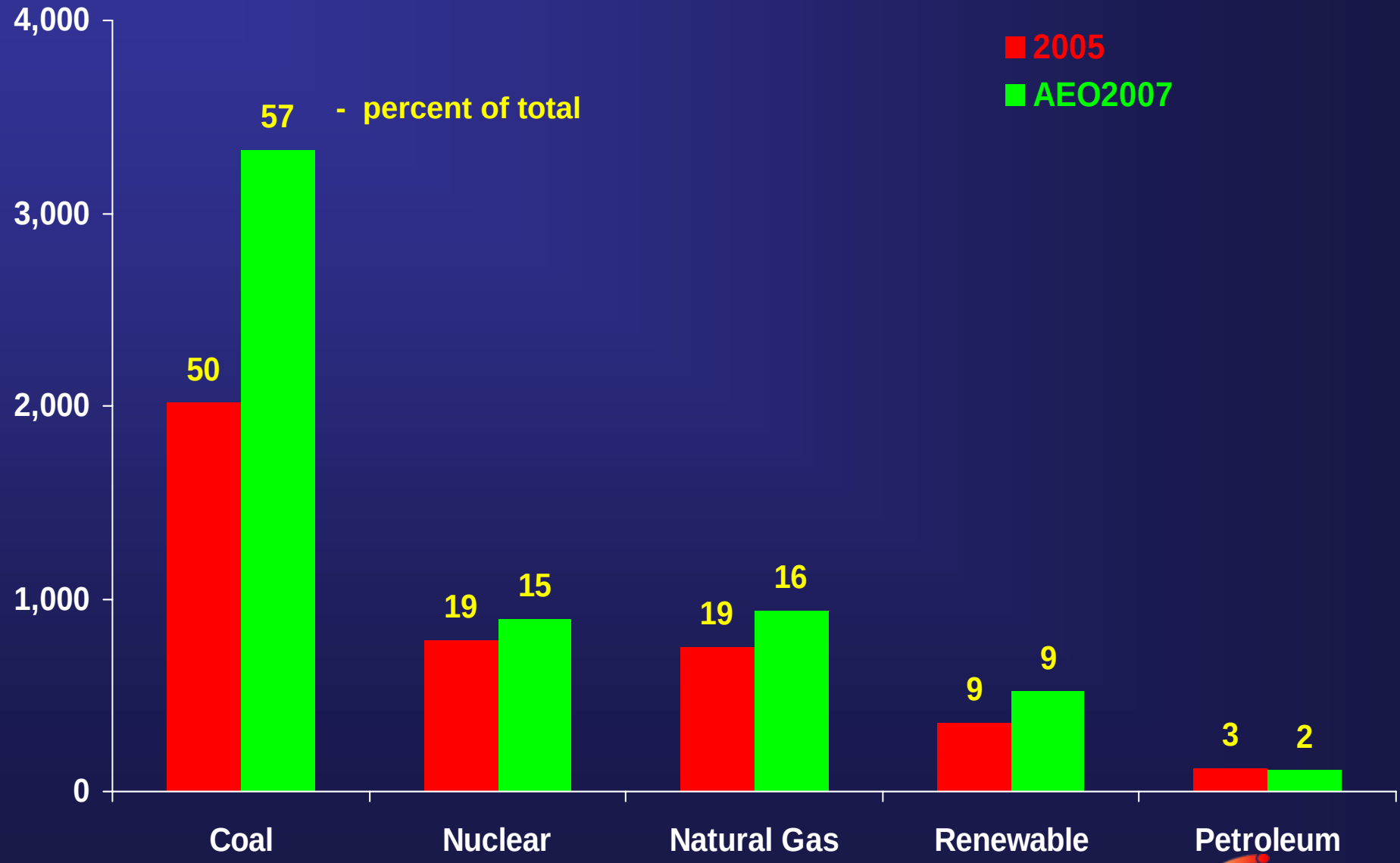
U.S. Electricity Generation Capacity Additions by Fuel, 2006-2030 (gigawatts)



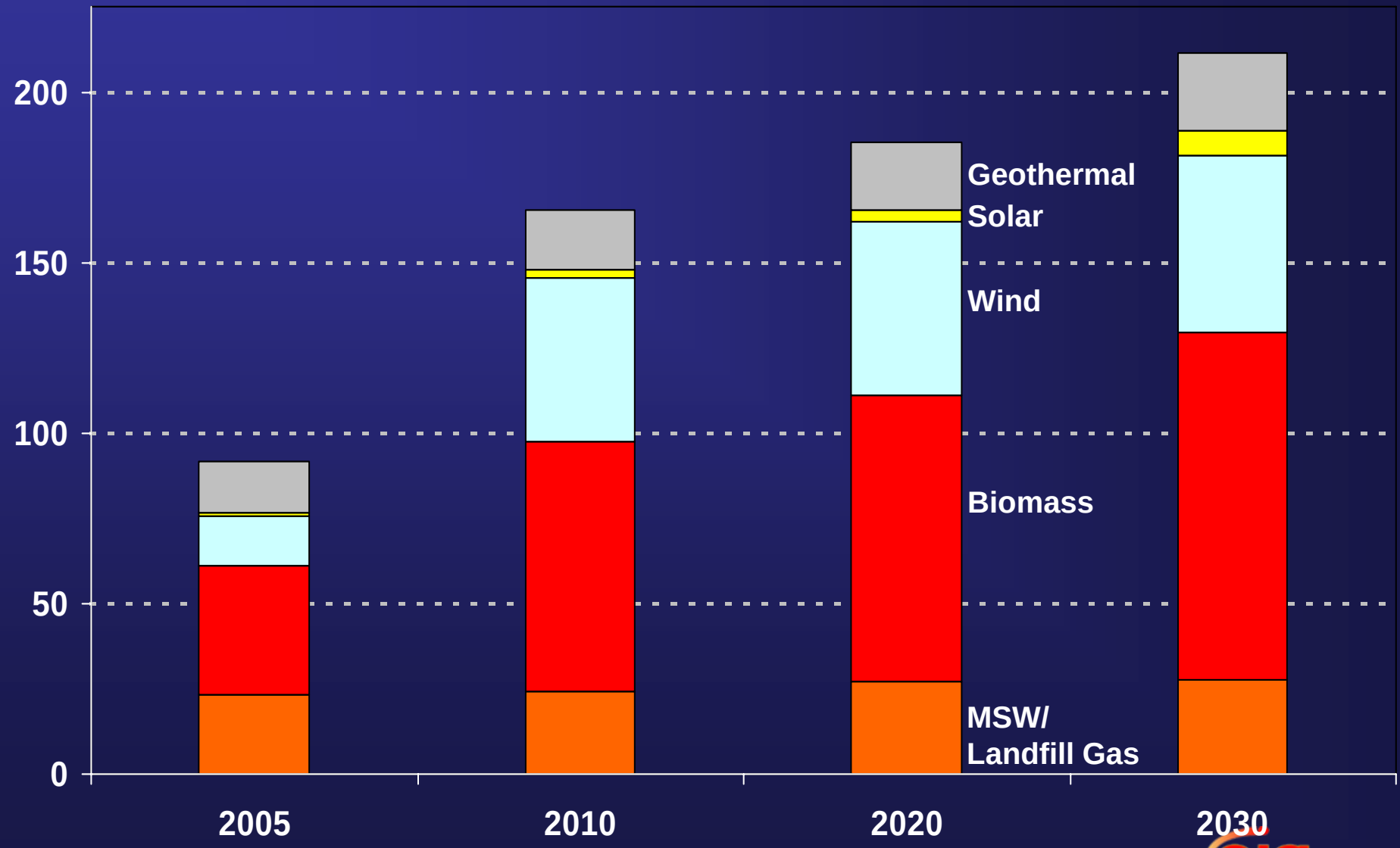
Levelized Electricity Costs for New Plants, 2015 and 2030 (2005 mills per kilowatthour)



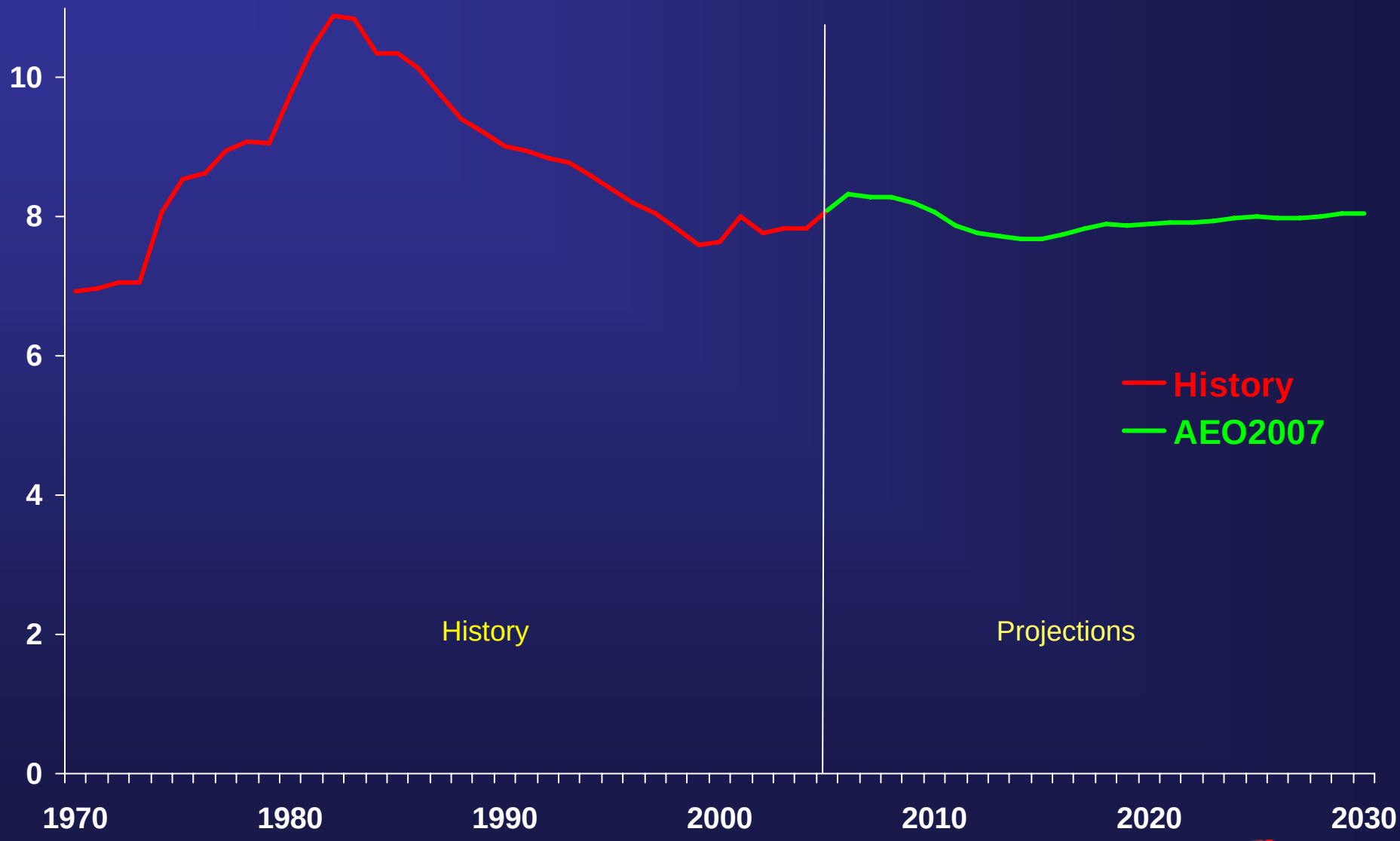
U.S. Electricity Generation by Fuel, 2005 and 2030 (billion kilowatthours)



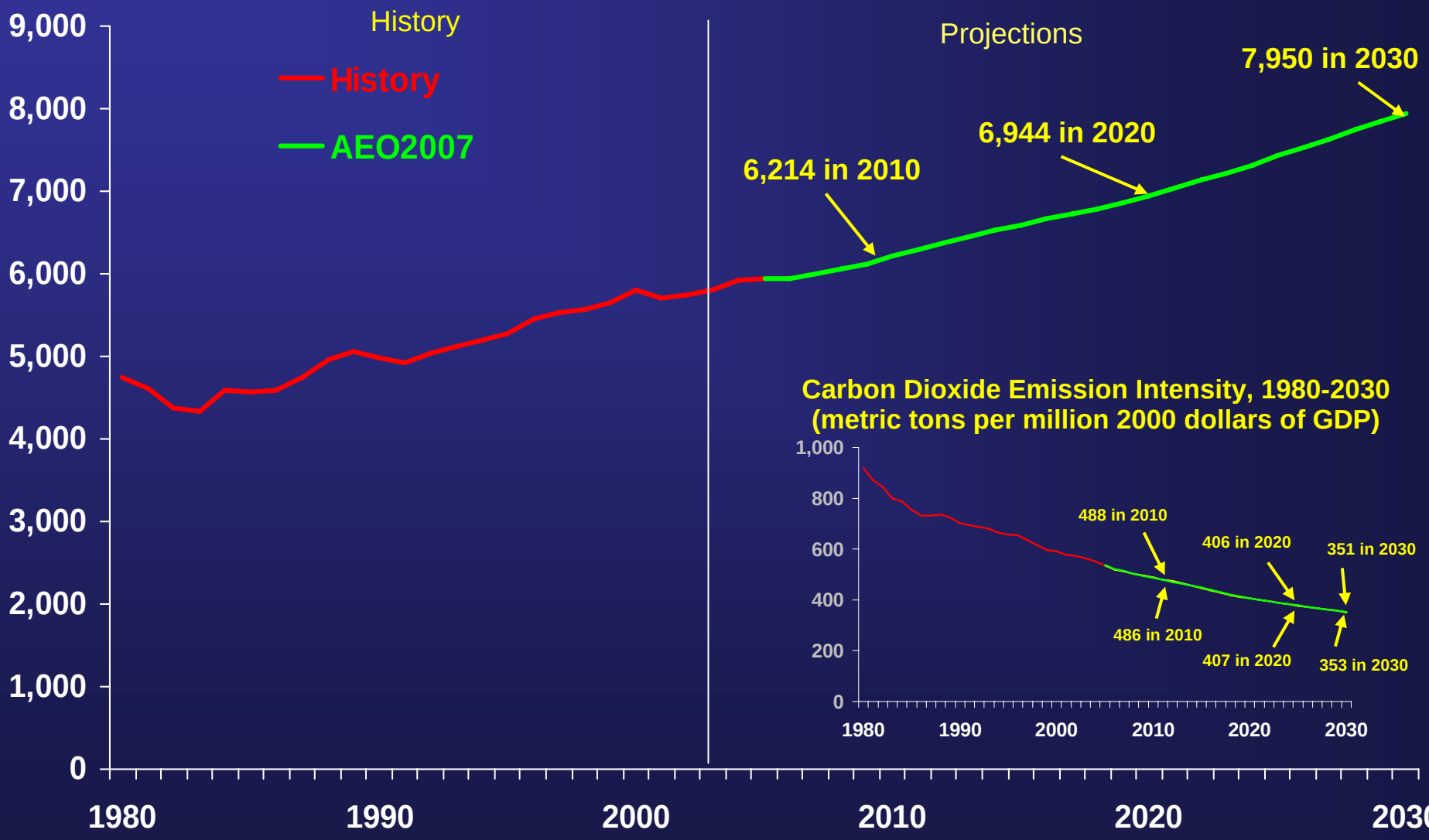
Nonhydroelectric Renewable Electricity Generation by Energy Source, 2005-2030 (billion kilowatthours)



U.S. Electricity Price, 1970-2030
(2005 cents per kilowatthour)



U.S. Energy-Related Carbon Dioxide Emissions, 1980-2030 (million metric tons)



Annual Energy Outlook 2007 reference case indicates that through 2030....

- Traditional fossil fuels are expected to continue to meet the bulk of energy requirements over the projection period
- U.S. energy demand is projected to grow at an average annual rate of 1.1 percent
- The energy efficiency of the economy is projected to increase at an average annual rate of 1.8 percent
- U.S. oil import dependency is projected to grow from 60 percent to 61 percent
- U.S. natural gas use is projected to be level off over the last decade of the projection
- Future growth in U.S. natural gas supplies depends on unconventional domestic production, natural gas from Alaska, and liquefied natural gas imports
- Carbon dioxide emissions are projected to grow at an average annual rate of 1.2 percent